

REMARKS

Claims 1-10, 15-18 and 21-26, of which claims 21-26 are new, are pending. Claims 11-14 and 19-20 have been canceled.

Entry of the above amendments is earnestly solicited. Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Each of the objections and rejections set forth in the Office action is addressed below.

Claims 8-10 were objected to under 37 CFR 1.75 as substantially duplicating claim 7. Each of claims 8-10, as amended, is non-duplicative of claim 7. Accordingly, withdrawal of this objection is respectfully requested.

Claims 13-14 were objected to under 37 CFR 1.75 as substantially duplicating claim 12. Claims 13-14 have been canceled. Accordingly, withdrawal of this objection is respectfully requested.

Claims 16-18 were objected to under 37 CFR 1.75 as substantially duplicating claim 15. Each of claims 16-18, as amended, is non-duplicative of claim 15. Accordingly, withdrawal of this objection is respectfully requested.

Claim 20 was objected to under 37 CFR 1.75 as substantially duplicating claim 19. Claims 19-20 have been canceled. Accordingly, withdrawal of this objection is respectfully requested.

Claims 7-10 and 12-14 were rejected under 35 U.S.C. 112, second paragraph, as allegedly being indefinite. Claims 12-14 have been canceled. With respect to claims 7-10, this rejection is respectfully traversed.

The Office Action contends, in paragraph 9, that the term "derivative" in claims 7-10 is not reasonably defined. However, the recited derivatives are reasonably defined to a person of ordinary skill in the art. For example, as recited in each of the rejected claims, as well as new claims 25 and 26, each recited derivative is an "electrolyte salt." One of ordinary skill in the art would have readily understood the scope and meaning of the term "derivative," particularly in the context in which it is recited. Consistent with that understanding, the specification acknowledges that, "[t]he electrolyte salt that can be used in the nonaqueous electrolyte composition of the invention is conventional." (Specification at paragraph 0053). Withdrawal of this rejection is respectfully requested.

Claims 1-2, 7-10 and 15-18 were rejected under 35 U.S.C. 102(b) as purportedly anticipated by Go (JP 2003-163032).

Claim 1 as amended, as well as each of the remaining claims by its incorporation of claim 1, recites a nonaqueous electrolyte composition comprising a silicon compound represented by general formula (1) or general formula (2). Go fails to teach or fairly suggest the provision of such a silicon compound. Accordingly, this rejection should be withdrawn.

Claims 1-2, 7-10 and 15-18 were rejected under 35 U.S.C. 102(b) as purportedly anticipated by Oh (U.S. Patent Application Publication No. 2003/0113634). Claim 6 was rejected under 35 U.S.C. 103(a) as purportedly unpatentable over Oh.

As noted, each of the pending claims recites a nonaqueous electrolyte composition comprising a silicon compound represented by general formula (1) or general formula (2). Oh fails to teach or fairly suggest the provision of such a silicon compound. Accordingly, these rejections should be withdrawn.

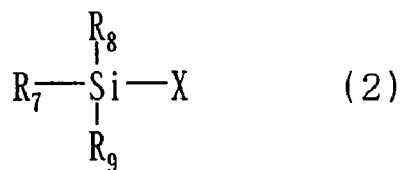
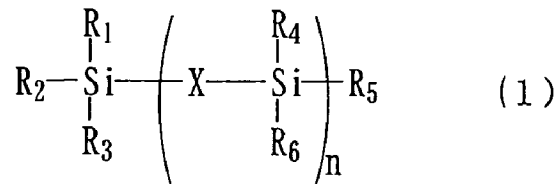
Claims 1, 7-10 and 15-18 were rejected under 35 U.S.C. 102(b) as purportedly anticipated by Gan (CA 2334054). Claims 3-5 and 19-20 were rejected under 35 U.S.C. 103(a) as purportedly unpatentable over Gan.

However, Gan also fails to teach or fairly suggest the provision of a silicon compound represented by general formula (1) or general formula (2). Accordingly, these rejections should be withdrawn.

Claims 11-14 were rejected under 35 U.S.C. 103(a) as purportedly unpatentable over the combination of Awano (JP 2004-039510) with any one of Go, Oh or Gan. For at least the following reasons, that rejection should be withdrawn.

Claims 11-14 have been canceled, the subject matter of claim 11 having been incorporated into independent claim 1. Thus, claim 1 recites a nonaqueous electrolyte composition comprising an organic solvent, an electrolyte salt dissolved in

the organic solvent and a silicon compound represented by general formula (1) or general formula (2), reproduced below:



Each of claims 2-10, 25 and 26 depends from claim 1. Claims 15-18 and 21-24 are directed to a nonaqueous electrolyte secondary battery that comprises a composition in accordance at least with claim 1.

In contrast, as the Office Action acknowledges, each of Go, Oh and Gan fails to disclose a silicon component, much less one that is represented by general formula (1) or general formula (2). Awano describes a silicon compound represented by applicant's general formula (2) in an organic solvent but fails to disclose the unique combination of organic solvent components and silicon compound which is recited in the present claims.

The compositions of the present invention yield cycle characteristics in a lithium secondary battery which are demonstrably greater, superior and unexpected relative to the cited prior art.

Accordingly, the presently claimed invention is non-obvious over the combinations relied upon by the Office Action. See MPEP § 716.02(a)(I) (“greater than expected results are evidence of nonobviousness”); MPEP § 716.02(a)(II) (“superiority of a property shared with the prior art is evidence of nonobviousness”); MPEP § 716.02(a)(III) (“presence of an unexpected property is evidence of nonobviousness”).

Applicant submits herewith the Declaration of Takayuki Taki, a co-inventor named in the instant application, pursuant to 37 CFR 1.132.

As outlined in that declaration, Comparative Examples 3-1 and 3-2 designate lithium secondary batteries which were formed using electrolyte compositions in accordance with Examples 1 and 2 of Awano, respectively, and including Awano's silicon compound no. 11 (Compound No. 10 in the present specification). Similarly, Examples 3-3 and 3-4 of the accompanying declaration designate lithium secondary batteries which also were formed using electrolyte compositions in accordance with Examples 1 and 2 of Awano, respectively, this time including Awano's silicon compound no. 12 (Compound No. 13 in the present specification). For convenience, it is noted that U.S. Patent Application Publication 2004/0007688 is believed to be an English language counterpart of Awano's JP 2004-039510.

Table 1 in the accompanying declaration reports test data for Comparative Examples 3-1 and 3-2 when subjected to the test protocol described in the present specification at pages 24 and 25. Table 1 of the declaration also provides the corresponding test data for Examples 2-3, 2-7, 2-11 and 2-15 of the present application, which relate to embodiments of the present invention using the same silicon compound as provided in Comparative Examples 3-1 and 3-2.

As Table 1 in the accompanying declaration plainly demonstrates, the compositions of the present invention yield cycle characteristics in a lithium secondary battery which are dramatically improved over the cycle characteristics obtained using the silicon-containing organic solvents of Awano. For example, the values for output after 500 cycles and discharge capacity after 500 cycles at 20°C are significantly higher for Examples 2-3, 2-7, 2-11 and 2-15 compared with Comparative Examples 3-1 and 3-2. At -30°C, these superior cycle characteristics provided by the embodiments of the present invention are even more pronounced.

Table 2 in the accompanying declaration reports test data obtained using Comparative Examples 3-3 and 3-4, as well as the data for corresponding Examples 2-4, 2-8, 2-12 and 2-16 of the present application.

As Table 2 in the accompanying declaration plainly demonstrates, these compositions of the present invention also

yield superior cycle characteristics in a lithium secondary battery when compared with the cycle characteristics obtained using the silicon-containing organic solvents of Awano. And again, these superior cycle characteristics provided by the embodiments of the present invention are even more pronounced at low temperature, e.g., -30°C.

Thus, the data presented in the accompanying Declaration conclusively demonstrate that the unique combination of organic solvent mixture and silicon compound as recited in each of the pending claims provides dramatic improvement of secondary battery cycle characteristics. As demonstrated, these improvements are not contemplated by Go, Oh or Gan, and significantly and unexpectedly exceed what is shown by Awano.

Moreover, Awano discloses electrolyte compositions using a silicon compound represented by general formula (1) as "comparative examples" and describes them as "insufficient" for improving cycle characteristics. (See Comparative Examples 1 and 2 in Awano). In contrast, in the compositions of the present invention, silicon compounds represented by general formula (1) accomplish superior cycle characteristics that are comparable to those obtained using silicon compounds represented by general formula (2). (See, e.g., Examples 2-1, 2-2, 2-5, 2-6, 2-9, 2-10, 2-13 and 2-14 in Tables 3 and 4 of the present specification). This distinction further

underscores that the superior results obtained using compositions of the present invention would have been unexpected and non-obvious over Awano and the remaining prior art of record.

In view of the foregoing amendments and remarks, the application is in condition for allowance at the time of the next Official Action. Allowance and passage to issue is respectfully requested.

Should there be any matters that need to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

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APPENDIX:

The Appendix includes the following item(s):

- ☒ - a 37 CFR 1.132 Declaration